

REMARKS

Summary of the Office Action

Claims 1-82 and 84-92 are pending in the present reissue application.

The Examiner has allowed claims 1-81.

Claims 82, 84 and 85 have been rejected under 35 U.S.C. § 103 as being unpatentable over "UC3842 Provides Low-Cost Current-Mode Control", SGS Power Supply Application Manual, July 1985 (hereinafter "the UC3842 reference") in view of

- (1) "Lambda Switching Regulators LSH 6355P 5 AMP DC-to-DC Microconverter" Datasheet, Lambda Semiconductors Databook, Vol. 1, 1988 (hereinafter "the LSH 6355P reference");
- (2) "Lambda Switching Regulators LSH 6335P 3 AMP DC-to-DC Microconverter", Lambda Semiconductors Databook, Vol. 1, 1988 (hereinafter "the LSH 6335P reference");
- (3) U.S. Patent No. 4,543,522 to Moreau, issued on September 24, 1985 (hereinafter "Moreau"); and

- (4) U.S. Patent No. 4,680,530 to Mashino,
issued on July 14, 1987 (hereinafter
"Mashino").

Claims 86-92 have been rejected under 35 U.S.C. § 103
as being unpatentable over the UC3842 reference in view of

- (1) "Types RC4193M, RC4193I, RC4193C Micropower
Switching Regulator" Datasheet, Texas Instruments,
December 1982 (hereinafter "the RC4193
reference"); and
- (2) "Type TL496C 9-Volt Power-Supply Controller"
Datasheet, Texas Instruments, August 1978 (Revised
December 1982) (hereinafter "the TL496C
reference").

Applicant's Response

Claim 82

The Examiner has rejected claim 82 over the UC3842
reference in view of the LSH 6335P reference, the LSH 6355P
reference, Moreau and Mashino on the grounds that it would have
been obvious to reduce the number of terminals required by the
UC3842 device by deleting the reference, time constant and
current sense terminals. Applicant respectfully traverses this
rejection for the following reasons.

First, the Examiner's proposed modifications to the
UC3842 device would render the UC3842 unsatisfactory for its
intended purpose. Hence, applicant submits that it would not

be obvious to eliminate the reference, time constant and current sense terminals from the UC3842 device.

The Manual of Patent Examination Procedures (hereinafter "the MPEP") states that "[i]f [a] proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." MPEP § 2143.01. The UC3842 reference describes using one or more of the reference, time constant and current sense terminals of the UC3842 device to

- (1) achieve very precise duty cycle limiting (the UC3842 reference, pages 74 and 80 and FIG. 7b);
- (2) synchronize the UC3842 oscillator to an external clock (the UC3842 reference, page 74 and FIG. 8);
- (3) implement transformer-coupled current sensing to "reduce power dissipation [through a current sense resistor], reduce errors caused by the base current, and provide level shifting to eliminate the restraint of ground-referenced sensing" (the UC3842 reference, page 76 and FIG. 13); and
- (4) provide slope compensation to prevent subharmonic oscillation and improve noise

immunity (the UC3842 reference, pages 78-80 and FIGS. 20a-b and 21).

If one were to eliminate the reference, time constant and current sense terminals of the UC3842 device as proposed by the Examiner, the UC3842 would become unsatisfactory for the intended purposes described in the UC3842 reference. Accordingly, pursuant to § 2143.01 of the MPEP, there is no suggestion or motivation to make the modifications proposed by the Examiner.

None of the remaining references cited against claim 82 (i.e., the LSH 6335P reference, the LSH 6355P reference, Moreau and Mashino) provides any motivation or suggestion to eliminate the reference, time constant and current sense terminals from the UC3842 device. The LSH 6335P and LSH 6355P references are for implementing voltage-mode switching voltage regulators. They are not for implementing current-mode switching voltage regulators. Current-mode switching voltage regulators control a switching pulse in a different way than voltage-mode switching regulators. See, e.g., the UC3842 reference at pp. 71-72, in which the current-mode scheme is contrasted to "conventional schemes in which the error signal directly controls pulse width without regard to inductor current." Current-mode provides performance advantages and has different frequency response characteristics. *Id.* See also the specification of the present reissue application at page 1, lines 39-45. Current-mode also requires additional circuitry, such as an inductor current sensing circuit, circuitry for providing the current sense signal as feedback, and a

comparator for comparing the inductor current sense feedback to an error signal from an error amplifier. The UC3842 has numerous terminals for accessing and completing this circuitry. The LSH 6335P and LSH 6335P do not teach that a current-mode voltage regulator circuit can be designed otherwise. Thus, the fact that the LSH 6335P and LSH 6355P voltage-mode devices have five terminals provides no suggestion that the UC3842 current-mode device can be modified to achieve the claimed invention.

Moreau and Mashino also do not describe current-mode switching voltage regulators. Rather, those patents describe other types of voltage regulators which lack circuitry for implementing a current-mode regulator. These references do not suggest that the UC3842 current-mode device can be modified to achieve the claimed invention, i.e., an integrated circuit for implementing a current-mode regulator that includes all of the circuitry recited by claim 82 in an integrated circuit having at most five terminals.

It is only with impermissible hindsight based on the disclosure of the present application that one might find a suggestion to design an integrated circuit for implementing a current-mode switching voltage regulator having at most five terminals. The art simply does not provide this suggestion.

Second, the UC3842 does not disclose other features of the claimed invention. Contrary to the statements made by the Examiner in the Office Action, the UC3842 reference does not describe an integrated circuit for implementing a current-

mode switching voltage regulator circuit comprising the following elements that are required by claim 82:

- (1) an integral power switching transistor;
- (2) an integral resistive element coupled in series with the collector-emitter circuit of the switching transistor; and
- (3) an amplifier coupled to the resistive element for generating a current sense signal indicative of the current conducted by the switching transistor that is provided to a means for comparing that signal to an error signal to provide variable duty cycle control (this is the basic current-mode control scheme discussed above).

The Examiner cites to FIG. 1 of the UC3842 reference as showing an integral power transistor. However, FIG. 1 of the UC3842 reference does not indicate that the power transistor is integral to an integrated circuit switching regulator. Indeed, the UC3842 reference indicates that the UC3842 device drives external power transistors. See, e.g., pages 71, 73, 75-77 and FIGS. 6, 12, 13, 15-17, 24. Moreover, it is unclear to applicant if the Examiner is citing to FIG. 1 of the UC3842 reference as showing an integral resistive element similar to that recited in claim 82. If so, applicant submits that the UC3842 reference indicates that the sense

resistor shown in FIG. 1 is disposed external to the UC3842 device. See, e.g., pages 75-76 and FIGS. 12-13.

Applicant previously demonstrated that the absence of these internal features from the UC3842 is significant because there is nothing in the art to suggest incorporating these features into a five terminal integrated circuit for implementing a current-mode switching regulator. Indeed, the art teaches away from attempting such a design. Applicant refers the Examiner to the discussion at pages 14-15 of Applicant's March 9, 1995 Response to Examiner's Action. A copy of the March 9, 1995 Response is attached hereto in Appendix A for the Examiner's convenience and is incorporated herein in its entirety.

Furthermore, Moreau and Mashino do not disclose at least features (2) and (3) above, and the LSH 6335P and LSH 6355P references do not disclose at least feature (3) above. Since none of the references teach all the above-described features, either alone or in combination, applicant respectfully submits that claim 82 is patentable thereover.

Claims 84 and 85

Because claims 84 and 85 depend on independent claim 82, claims 84 and 85 are patentable at least for the same reasons provided above.

Claim 86

The Examiner has rejected claim 86 over the UC3842 reference in view of the RC4193 and TL496C references on the grounds that the UC3842 reference discloses all the features recited by the present claim except for a shutdown state, which the Examiner alleges is disclosed by the RC4193 and TL496C references. Applicant respectfully traverses this rejection for the following reasons.

First, claim 86 of the present reissue application is patentable over the UC3842, RC4193 and TL496C references because none of the references disclose an integrated circuit having

- (1) a shutdown circuit that deactivates the reference circuit; and
- (2) a driver circuit coupled to provide a base drive current to the switching transistor, the driver circuit responsive at least in part to the error signal for causing the base drive current provided to the switching transistor to vary.

An exemplary embodiment of the claimed variable driver circuit is disclosed by commonly-assigned, commonly-invented U.S. Patent No. 4,755,741, which the present reissue application specifically incorporates by reference. This patented feature of the presently claimed invention increases the efficiency of operation of the switching transistor, as opposed to typical

switching regulators, which provide constant base drive current to the switching transistor. Because none of the references, either alone or in combination, describe the features itemized above, applicant submits that claim 86 is patentable thereover.

Second, contrary to the statements made by the Examiner in the Office Action, the UC3842 reference does not describe an integrated circuit for implementing a current-mode switching voltage regulator circuit comprising the following features that are required by claim 86:

- (1) an integral power switching transistor structure;
- (2) an integral resistive element coupled in series with the current path in the switching transistor structure; and
- (3) an amplifier coupled to the resistive element for generating a current sense signal indicative of the current conducted by the switching transistor that is provided to a circuit for comparing that signal to an error signal to provide variable duty cycle control.

The two remaining references cited against claim 86 by the Examiner (i.e., the RC4193 and TL496C references) do not disclose at least features (2) and (3) above. Accordingly, applicant respectfully submits that claim 86 is patentable over the UC3842, RC4193 and TL496C references.

Third, the power-up sequencing problems taught by the TL496C reference do not provide any motivation or suggestion to add the shutdown circuit recited in the present claim to the UC3842 device. The Examiner states that it would have been obvious to add a shutdown circuit to the UC3842 device "since the inventor of the UC3842 would have been drawn to the beneficial feature of eliminating power-up sequencing problems taught by the references." 04.16.04 Office Action, pages 4-5. The Examiner appears to derive this statement from the following statements made in the TL496C reference:

The design of the TL496 allows minimal supply current drain during stand-by operation (125 μ A typical). With most battery sources this allows a constant bias to be maintained on the power supply. This makes power instantly available to the system thus eliminating power-up sequencing problems.

(emphasis added). TL496C reference, page 2-101.

Applicant respectfully submits that this statement from the TL496C reference does not suggest that power-up sequencing is eliminated by adding a shutdown circuit. Rather, this statement suggests that the problem of power-up sequencing (potentially experienced as a consequence of entering a shutdown state) is eliminated by allowing constant bias to the power supply, thus making power instantly available to the system. Accordingly, applicant respectfully submits that the UC3842, RC4193 and TL496C references do not provide one of ordinary skill in the art any motivation or suggestion to add

the shutdown circuit recited in the present claim to the UC3842 device.

Claims 87 and 88

Because claims 87 and 88 depend on independent claim 86, claims 87 and 88 are patentable at least for the same reasons provided above.

Claim 87 further is patentable over the references cited by the Examiner because none of the UC3842, RC4193 and TL496C references, either alone or in combination, describe a shutdown circuit responsive to a signal externally applied to the compensation terminal.

Claim 89

The Examiner has rejected claim 89 over the UC3842 reference in view of the RC4193 and TL496C references. Applicant respectfully traverses this rejection for many of the same reasons discussed above with respect to claims 82 and 86 of the present reissue application. For example, the UC3842 reference does not describe an integrated circuit for implementing a current-mode switching voltage regulator circuit comprising the following features that are required by claim 89:

- (1) an integral power switching transistor structure;

- (2) an integral resistive element coupled in series with the current path in the switching transistor structure; and
- (3) an amplifier coupled to the resistive element for generating a current sense signal indicative of the current conducted by the switching transistor that is provided to a circuit for comparing that signal to an error signal to provide variable duty cycle control.

Additionally, the cited references do not teach or suggest how the UC3842 device could be modified to require connection to no more than five different nodes among the external components to implement a current-mode switching regulator circuit. See applicant's discussion above with respect to claim 82.¹ The UC3842 reference does not describe or suggest that the UC3842 device can be connected to only five different nodes among external components to implement a current-mode switching regulator circuit. The application circuit illustrated on page 81 of the UC3842 reference shows connection of eight terminals to eight different nodes.

The RC4193 and TL496C references do not provide any further guidance, particularly since neither the RC4193 reference nor the TL496C reference describe current-mode

¹ Applicant notes that, in the 04.16.04 Office Action, the Examiner does not provide any reason as to why claim 89 is unpatentable over the RC4193 and TL496C references.

switching regulator circuits as required by claim 89. As discussed above, the UC3842 device has numerous terminals for accessing and completing circuits required for current-mode control and does not show or suggest that it can be connected to only five different nodes among external components to implement a current-mode switching regulator circuit. The RC4193 and TL496C references do not teach that a current-mode voltage regulator circuit can be designed otherwise.

Claims 90-92

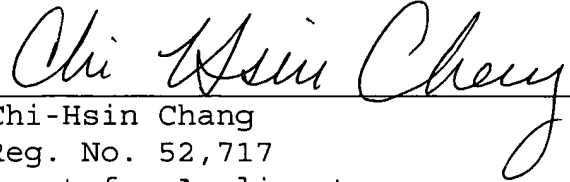
Because claims 90-92 depend on independent claim 89, claims 90-92 are patentable at least for the same reasons provided above.

Claims 90 and 91 further are patentable for the same reasons discussed above with respect to claims 86 and 87.

Conclusion

In light of the discussion provided herein, applicant respectfully submits that claims 1-82 and 84-92 are in condition for allowance, and respectfully requests the same.

Respectfully submitted,



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APPENDIX A